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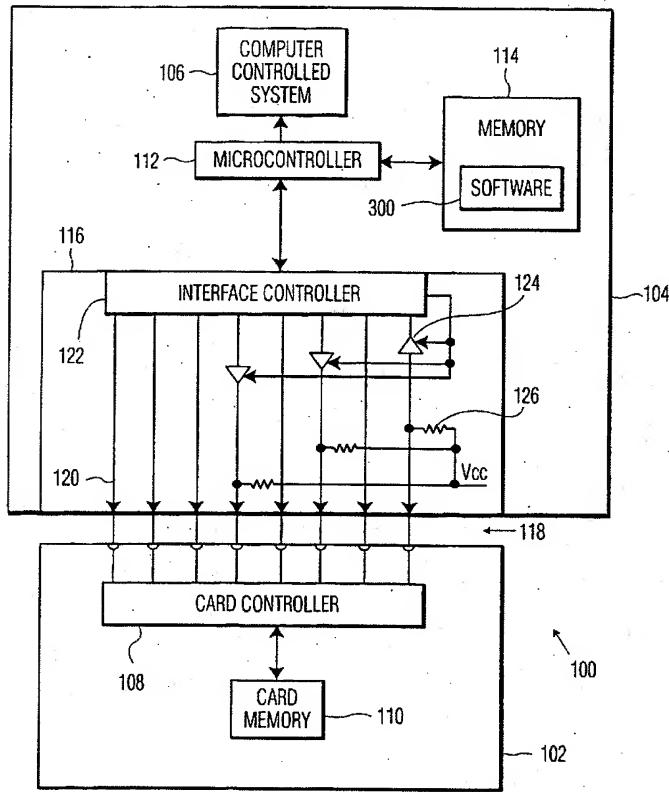
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(54) Title: METHOD AND APPARATUS FOR SUPPORTING TWO DIFFERENT TYPES OF INTEGRATED CIRCUIT CARDS WITH A SINGLE CONNECTOR





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## METHOD AND APPARATUS FOR SUPPORTING TWO DIFFERENT TYPES OF INTEGRATED CIRCUIT CARDS WITH A SINGLE CONNECTOR

### BACKGROUND OF THE DISCLOSURE

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#### 1. Field of the Invention

The present invention relates to interfaces in a system using integrated circuit (IC) cards. More particularly, the invention relates to a method and apparatus for supporting two different IC card standards using a single IC card connector.

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#### 2. Description of the Background Art

Integrated circuit (IC) cards, such as smart cards, are used in a variety of consumer electronics devices, including pay TV systems, set top cable television boxes, terrestrial television receivers, satellite television receivers and the like. Two types of IC card are based upon the ISO/7816 standard for conventional IC cards and the NRSS standard for IC cards having high-speed data transfer ports.

The current IC card systems comprise a connector that is capable of supporting (or operating as an interface to) only one type of IC card. For example, a connector capable of supporting an ISO/7816 card cannot support a NRSS card, and vice versa. In order to support both types of IC cards, the IC card system would require an additional IC card connector. Therefore, a need exists for an IC card interface capable of supporting ISO/7816 and NRSS cards with a single connector.

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### SUMMARY OF THE INVENTION

The invention overcomes the disadvantages associated with the prior art by providing a method and apparatus capable of receiving ISO/7816 and NRSS cards with a single connector. The apparatus is a computer-controlled device

comprising a card reader that further comprises an interface controller and a connector. The connector, which comprises eight pins, forms an interface between the computer controlled device and eight corresponding contacts of the IC card, i.e., contacts C1 through C8. The interface controller determines

5 whether the IC card inserted into the card reader is an ISO/7816 or NRSS card and provides the correct interface for the IC card.

Specifically, an interface controller sends a test signal to the input/output contact (C7) of the IC card and detects this contact (C7) to determine whether the IC card sends a reply or answer signal in response to the test signal. The 10 test signal is selected such that one type of IC card replies to the test signal, while the other type of IC card responds differently, e.g., is non-responsive, to the test signal. Once the interface controller determines the type of IC card, the interface controller implements the correct interface for the detected IC card.

*For example, the interface may comprise buffers and pull-up resistors. Buffers 15 block selected signals in the connectors (associated with contacts C4, C6 and C8) unless enabled by the interface controller. If the interface controller detects the IC card as a NRSS card, then the interface controller sends a "buffer enable" signal to the buffers. Pull-up resistors are coupled to connectors associated with selected contacts (C4, C6 and C8) on the IC card, in case the IC card is a NRSS 20 card.*

The inventive method comprises the steps of determining whether an IC card is an ISO/7816 or NRSS card and implementing an interface for the identified IC card. The determining step further includes the steps of applying a test signal to the IC card and identifying whether the IC card transmits a reply 25 signal in response to the test signal. The implementing step may include blocking or enabling a buffer such that signals are transmitted to selected contacts of one type of IC card (i.e., a NRSS card) and blocked to selected contacts of the other type of IC card (i.e., an ISO/7816 card).

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 depicts a block diagram of an integrated circuit (IC) card system including a IC card interface that operates in accordance with the present invention;

FIG. 2 depicts an assignment of signal contacts on a IC card; and

FIG. 3 depicts a flow diagram showing the operation of the present invention.

To facilitate understanding, identical reference numerals have been used, where possible, to designate identical elements that are common to the figures.

DETAILED DESCRIPTION

FIG. 1 depicts an integrated circuit (IC) card system 100 comprising an IC card 102 and a computer controlled device 104. The IC card 102 is typically a smart card, an access card or a memory card for enabling the computer-controlled device 104 to operate a computer controlled system 106. The IC card 102 comprises a card controller 108 and a card memory 110. The card controller 108 coordinates signal and data transfer between the card memory 110 and the computer controlled device 104.

The IC card 102 includes an arrangement of contacts that generally comply with either the conventional ISO/7816 standard or the NRSS standard for high-speed data transfer. Variations of the ISO/7816 and NRSS cards are contemplated within the scope of the invention.

The computer-controlled device 104 generally includes any device that operates a computer-controlled system 106 upon receipt of the IC card 102. Examples of such computer-controlled devices 104 include a direct broadcast satellite television system, set top cable television boxes for cable and video-on-demand systems, high definition television system, terrestrial television receivers, satellite television receivers and other similar devices.

The computer-controlled device 104 comprises a computer-controlled system 106, a microcontroller 112, a memory 114 and a card reader 116. The microcontroller 110 is a processor that retrieves and executes a card reading software or routine 300 from the memory 114, instructs the card reader 116 to 5 detect the IC card 102 received therein, and activates the computer controlled system 106 upon an acknowledgement from the card reader 116. The computer-controlled system 106 is a system or module that operates the IC card system 100 in response to a signal from the microcontroller 112. The memory 114 stores the card reading routine 300 or method, as well as other applications 10 for implementing the IC card system 100.

The card reader 116 couples the IC card 102 to the computer-controlled device 104 at an interface 118. The card reader 116 comprises a connector 120 and an interface controller 122. The connector 120 comprises eight pins that form the interface 118 between the interface controller 122 and the IC card 15 102. If the pins are coupled to the contacts of the IC card 102, then these pins form conductive paths for transmitting or receiving signals and data through the interface 118. Additionally, the card reader 116 comprises a buffer 124 and a resistor 126 for further defining the interface 118.

The signals and data at the interface 118 are typically assigned to the 20 contacts of the ISO/7816 and NRSS cards as depicted in FIG. 2. Five of the contacts have the same assigned signals for the two types of IC cards 102 depicted, namely: supply voltage, reset signal, clock signal, ground and data input/output. Another contact, typically the sixth contact (C6) of the IC card 102, is assigned to a programming signal for the ISO/7816 card and a NRSS 25 clock signal for the NRSS card. The two remaining contacts, typically the fourth and eighth contacts (C4 and C8) on the IC card 102, are undefined for ISO/7816 cards, but represent high speed data input and output paths on NRSS cards.

The buffer 124 is coupled to the interface controller 122 and the pins of the connector associated with contacts C4, C6 and C8 of the IC card 102.

Specifically, the buffer 124 may block or disable the conductive path to and from the contacts C4, C6 and C8. If the buffer 124 receives a "buffer enable" signal from the interface controller 122, then the buffer 124 enables the conductive path between the interface controller 122 and contacts C4, C6 and 5 C8 of the IC card 102.

The resistor 126 is coupled to a supply voltage, typically 5 volts, as well as to the pins of the connector associated with contacts C4, C6 and C8 of the IC card 102. If the buffer 124 blocks the conductive path to and from these contacts C4, C6 and C8, the pins associated with these connector are "pulled 10 up" to the supply voltage. In this case, the supply voltage drives the contacts C4, C6 and C8. The pull up resistor 126 is generally of high resistance, such that the effect on the conductive path is minimal when the buffer 124 is enabled, i.e., a "weak" pull-up.

The interface controller 122 is a processor that determines whether the IC 15 card 102 is an ISO/7816 or NRSS card. The interface controller 122 performs this determination while the microcontroller executes the routine or method 300. Once the correct IC card 102 is determined, the interface controller 122 implements the correct interface 118 for the ISO/7816 or NRSS card 102. The 20 steps for determining the type of IC card 102 and implementing the correct interface for the IC card 102 are described with respect to FIG. 3.

FIG. 3 depicts a flow diagram of the routine or method 300 used in the present invention. Specifically, the microcontroller 112 executes the method 300 and the interface controller 122 implements the method 300 for determining whether the received IC card 102 is an ISO 7816 or NRSS card.

Once the IC card 102 is inserted into the card reader 116, the method 25 300 starts at step 302. At step 304, the method 300 assumes that the received IC card 102 is an ISO/7816 card. At this point, the buffers 124 are disabled for blocking the conductive path to and from contacts C4, C6 and C8

of the IC card 102. The pins associated with these contacts are pulled up to the supply voltage.

At step 306, the method 300 instructs the interface controller 122 to apply a test signal or a reset signal to contact C7 on the IC card 102. The test signal is selected such that the card controller 108 in one type of IC card 102 responds to the test signal, whereas the card controller 108 in the other type of IC card 102 responds differently, e.g., is non-responsive, to the test signal. For example, the test signal or reset signal may elicit a response from the ISO/7816 card and no response from the NRSS card.

At step 308, the interface controller 122 determines whether the received IC card 102 is a NRSS card. Specifically, the interface controller 122 determines whether the card controller 108 of the IC card 102 transmits a reply signal on contact C7. If the selected test or reset signal elicits a response from only an ISO/7816 card, the interface controller 122 checks for the absence of a reply signal from the IC card 102.

If the interface controller 122 identifies the IC card 102 as a NRSS card, the method 300 proceeds to step 310, where the interface controller 122 implements an interface 118 for the NRSS card. In this case, the interface controller 122 sends buffer enable signals to the buffers 124. Once the buffers 124 receive the buffer enable signal, the interface controller 122 may transmit NRSS input data and NRSS clock signals to contacts C4 and C6, and receive NRSS output data from contact C8 of the NRSS card.

If the interface controller 122 identifies the IC card 102 as an ISO/7816 card, the method 300 proceeds to step 312, where the interface controller 122 implements an interface 118 for the ISO/7816 card. In this case, there are no buffer enable signals and the buffers 124 continue to disable the conductive paths to and from contacts C4, C6 and C8 of the ISO/7816 card.

Although one embodiment, which incorporates the teachings of the present invention, has been shown and described in detail herein, those skilled in

the art can readily devise many other varied embodiments that still incorporate these teachings.

What is claimed is:

1. A computer controlled device comprising:
  - a card reader, coupled to said microcontroller, operating as an interface for both ISO/7816 and NRSS cards, said card reader having
    - means for producing a first signal to the interface between said card reader and an IC card;
    - means for analyzing whether the IC card produces a second signal in response to the first signal.
2. The computer controlled device of claim 1 wherein said card reader applies the first signal to an input/output contact of the IC card and monitors whether the IC card produces the second signal at the input/output contact of the IC card.
3. The computer controlled device of claim 1 wherein said card reader comprises:
  - an interface controller for implementing an interface for a specific type of IC card detected by said card reader.
4. The computer controlled device of claim 3 wherein said card reader further comprises:
  - a connector, coupled to said interface controller, for providing a conductive path between said interface controller and the IC card.
5. The computer controlled device of claim 4 wherein said card reader further comprises:

a buffer, coupled between said interface controller and said connector, for blocking a conductive path to a contact of the IC card unless said buffer receives an enable signal from said interface controller; and

a resistor, coupled to said connector, for coupling the contact of the IC card to a supply voltage.

6. A method of providing an interface for ISO/7816 and NRSS cards, the method comprising the steps of:

    determining whether an integrated circuit (IC) card is a ISO/7816 card or a NRSS card; and

    implementing an interface for the identified IC card.

7. The method of claim 6 wherein said determining step comprises the steps of:

    applying a test signal to the IC card; and

    identifying whether the IC card transmits a particular reply signal in response to the test signal.

8. The method of claim 7 wherein the test signal is selected such that an ISO/7816 card transmits a reply signal in response to the test signal and a NRSS card is non-responsive to the test signal.

9. The method of claim 7 wherein the test signal is a reset signal.

10. The method of claim 6 wherein said implementing step comprises the step of disabling selected contacts of the IC card if said determining step identifies the IC card as an ISO/7816 card.

11. The method of claim 6 wherein said implementing step comprises the step of enabling selected contacts of the IC card if said determining step identifies the IC card as a NRSS card.
12. An apparatus for receiving ISO/7816 and NRSS cards with one interface, the apparatus comprising:
  - an interface capable of distinguishing between ISO/7816 and NRSS cards;
  - a IC card comprising a IC card controller; and
  - a computer-controlled device for implementing said interface for the ISO/7816 and NRSS cards upon receipt of said IC card.
13. The apparatus of claim 12 wherein said computer-controlled device comprises:
  - a memory for storing computer code;
  - a microcontroller, coupled to said memory, for executing computer code; and
  - a card reader, coupled to said microcontroller, operating as an interface for ISO/7816 cards and NRSS cards.

**AMENDED CLAIMS**

[received by the International Bureau on 11 December 2000 (11.12.00);  
new claim 14 added; remaining claims unchanged (1 page)]

11. The method of claim 6 wherein said implementing step comprises the step of enabling selected contacts of the IC card if said determining step identifies the 5 IC card as a NRSS card.
12. An apparatus for receiving ISO/7816 and NRSS cards with one interface, the apparatus comprising:
  - an interface capable of distinguishing between ISO/7816 and NRSS cards;
  - 10 a IC card comprising a IC card controller; and
  - a computer-controlled device for implementing said interface for the ISO/7816 and NRSS cards upon receipt of said IC card.
13. The apparatus of claim 12 wherein said computer-controlled device 15 comprises:
  - a memory for storing computer code;
  - a microcontroller, coupled to said memory, for executing computer code; and
  - 20 a card reader, coupled to said microcontroller, operating as an interface for ISO/7816 cards and NRSS cards.
14. A computer controlled device comprising:
  - a card reader, coupled to a microcontroller, said card reader operative as an interface for both ISO/7816 and NRSS cards, said card reader having:
    - 25 a controller for configuring a plurality of connection paths in an initial configuration associated with only one of said ISO/7816 and NRSS cards;
    - a circuit for producing a first signal to the interface between said card reader and an IC card over one communication path; and
    - 30 a circuit for analyzing whether the IC card produces a second signal in response to the first signal.

1/2

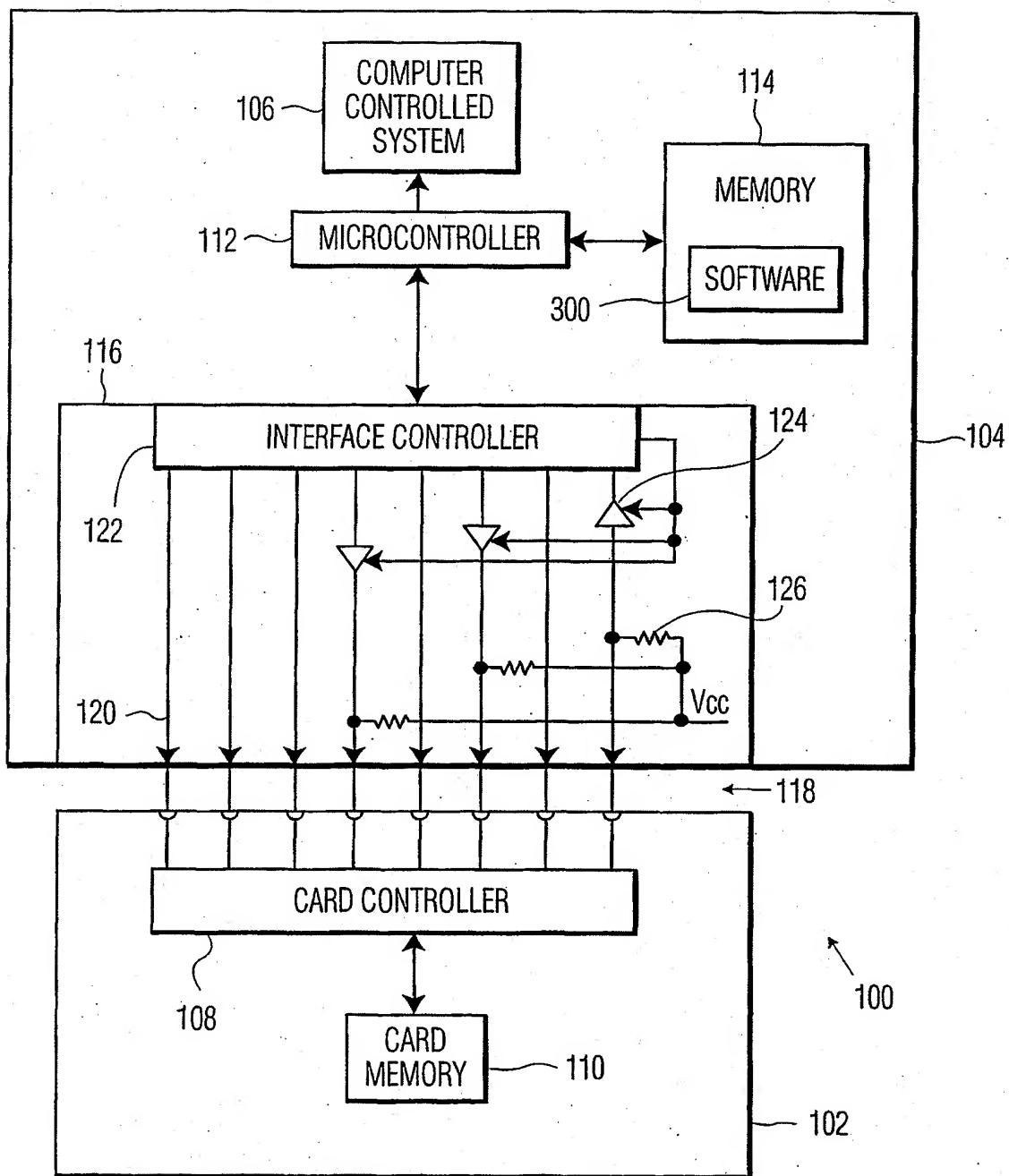


FIG. 1

2/2

CONTACT#	ISO/7816 ASSIGNMENT	NRSS ASSIGNMENT
C1	VCC (SUPPLY VOLTAGE)	VCC (SUPPLY VOLTAGE)
C2	RST (RESET SIGNAL)	RST (RESET SIGNAL)
C3	CLK (CLOCK SIGNAL)	CLK (CLOCK SIGNAL)
C4	RESERVED	NRSS DATA INPUT
C5	GND (GROUND)	GND (GROUND)
C6	VPP (PROGRAMMING VOLTAGE)	NRSS CLOCK SIGNAL
C7	I/O (DATA INPUT/OUTPUT)	I/O (DATA INPUT/OUTPUT)
C8	RESERVED	NRSS DATA OUTPUT

FIG. 2

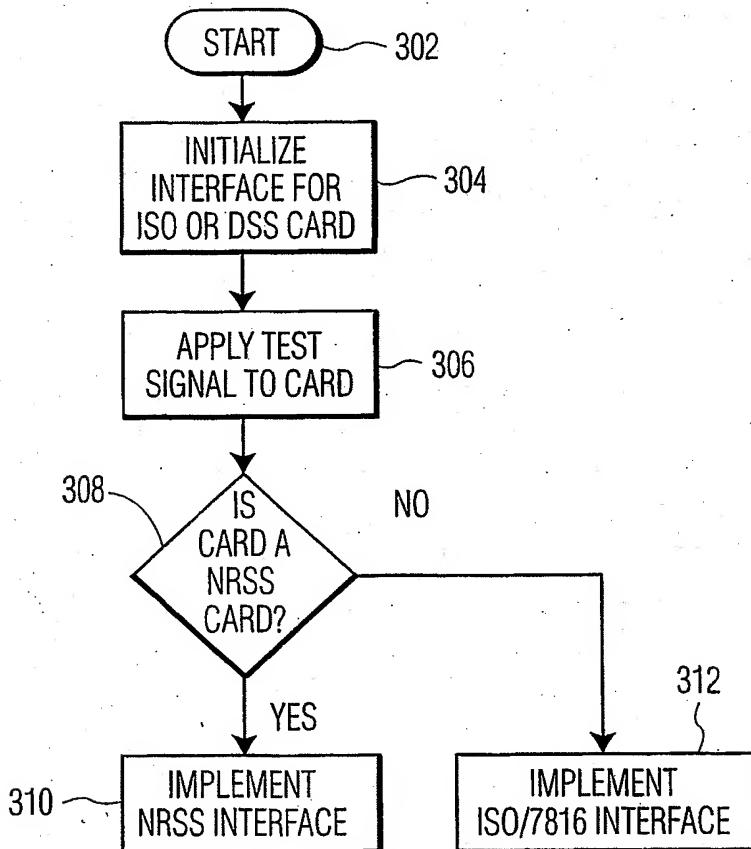


FIG. 3

# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/US 00/18893

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC 7 G06K7/00

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G06K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC, IBM-TDB

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	EP 0 409 241 A (TOKYO SHIBAURA ELECTRIC CO) 23 January 1991 (1991-01-23) claims 1,2,4,5	1,2,6-8, 10,11 4,5,12
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X	US 5 712 472 A (LEE SUNG-CHEOUL) 27 January 1998 (1998-01-27) claims 1,2,5	1,6-8,12

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

° Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

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Date of the actual completion of the international search

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**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International Application No

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